



CALIBRATION LABORATORIES

NVLAP LAB CODE 200625-0

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2005

<p>Scantek, Inc. Calibration Laboratory 6430 Dobbin Road, Suite C Columbia, MD 21045 Mr. Richard J. Peppin Phone: 410-290-7726 Fax: 410-290-9167 E-mail: peppinr@scantekinc.com URL: http://www.scantekinc.com</p>	<p>Parameter(s) of Accreditation Electromagnetics – DC/Low Frequency Time and Frequency Mechanical</p> <p>This laboratory is compliant to ANSI/NCSL Z540-1-1994; Part 1. (NVLAP Code: 20/A01)</p>
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CALIBRATION AND MEASUREMENT CAPABILITIES (CMC) ^{Notes 1,2}

Measured Parameter or Device Calibrated	Range	Uncertainty ($k=2$) ^{Note 3}	Remarks
ELECTROMAGNETICS – DC/LOW FREQUENCY			
<p>NVLAP Code: 20/E05 DC RESISTANCE AND CURRENT DC Current</p>	<p>1 mA to 10 mA</p> <p>10 mA to 100 mA</p> <p>100 mA to 1 A</p> <p>1 A to 3 A</p>	<p>At actual conditions. 0.11 % of reading + 0.002 mA</p> <p>0.12% of reading + 0.005 mA</p> <p>0.25% of reading + 0.1 mA</p> <p>0.2 % of reading + 0.6 mA</p>	<p>Agilent 34401A</p>
<p>DC Resistance (4-wires)</p>	<p>1 Ω to 100 Ω</p> <p>100 Ω to 1 kΩ</p> <p>1 kΩ to 10 kΩ</p> <p>10 kΩ to 100 kΩ</p> <p>100 kΩ to 1 MΩ</p>	<p>At actual conditions. 0.1 % of reading + 0.006 Ω</p> <p>0.1 % of reading + 0.04 Ω</p> <p>0.1% of reading + 0.4Ω</p> <p>0.1 % of reading + 4 Ω</p> <p>0.1% of reading + 40 Ω</p>	<p>Agilent 34401A</p>
<p>NVLAP Code: 20/E06 DC VOLTAGE</p>		<p>At actual conditions.</p>	

2012-04-01 through 2013-03-31
Effective dates

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Measured Parameter or Device Calibrated	Range	Uncertainty ($k=2$) ^{Note 3}	Remarks
DC Voltage	1 mV to 100 mV	0.0055 % of reading + 0.0036 mV	Agilent 34401A
	100 mV to 1 V	0.0055 % of reading + 0.007 mV	
	1 V to 10 V	0.0055 % of reading + 0.05 mV	
	10 V to 100 V	0.0055 % of reading + 0.6 mV	
	100 V to 1000 V	0.0055 % of reading + 0.01 V	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ($k=2$) ^{Note 3}	Remarks
NVLAP Code: 20/E09 LF AC VOLTAGE AC Voltage – Measuring equipment: Generate	10 μ V _{pp} to 40 V _{pp}	0.001 Hz to 200 kHz	At actual conditions. 1.1 % 61 μ Hz/Hz + 4 mHz	SR DS360 Generate: Sine, Square, two-tone
	ON: 1/2, 1 to 65534 periods; Rep. Rate 1 to 65535; Off attenuation to 10 kHz: >70 dB 10 μ V _{pp} to 40 V _{pp}	0.001 Hz to 200 kHz	1.1 % 61 μ Hz/Hz + 4 mHz	SR DS360 Generate: Sine or square bursts
	10 μ V _{pp} to 40 V _{pp}	1 Hz to 100 kHz CF: 11 dB 10 Hz – 200 kHz CF: 12 dB	1 dB 2 dB	Broadband noise: white Pink noise: measured with 1/3 octave analysis
AC Voltage Transfer – Measuring equipment: Measure	1 mV to 100 mV	10 Hz to 50 kHz	0.001 % of reading + 0.002 mV	Agilent 34401A
	100 mV to 1 V		0.001% of reading +0.02 mV	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) ^{Note 3}	Remarks	
AC Voltage: True RMS	1V to 10 V	50 kHz to 200 kHz	0.001% of reading + 0.2 mV	N-1504A System	
	10 V to 100 V		0.001% of reading + 2 mV		
	100 V to 750 V		0.001 % of reading + 15 mV		
	1 mV to 100 mV		0.001 % of reading + 0.005 mV		
	100 mV to 1 V		0.001 % of reading + 0.05 mV		
	1 V to 10 V		0.001 % of reading + 0.5 mV		
	10 V to 100 V		0.001 % of reading + 5 mV		
	100 V to 750 V		0.001 % of reading + 37.5 mV		
	50 μV to 1 mV	20 Hz to 20 kHz 3 Hz to 100 kHz	At actual conditions. 0.24 dB 0.40 dB		
	1 mV to 100 mV	3 Hz to 5 Hz	At actual conditions. 1.0 % of reading + 0.04 mV		Agilent 34401A
		5 Hz to 10 Hz	0.36 % of reading + 0.04 mV		
		10 Hz to 20 kHz	0.12 % of reading + 0.04 mV		
		20 kHz to 50 kHz	0.16 % of reading + 0.05 mV		
		50 kHz to 100 kHz	0.62 % of reading + 0.08 mV		
100 mV to 1 V	100 kHz to 300 kHz 3 Hz to 5 Hz	4.0 % of reading + 0.50 mV 1.0 % of reading + 0.2 mV			

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ($k=2$) ^{Note 3}	Remarks
	1 V to 10 V	5 Hz to 10 Hz	0.36 % of reading + 0.3 mV	
		10 Hz to 20 kHz	0.12 % of reading + 0.3 mV	
		20 kHz to 50 kHz	0.16 % of reading + 0.5 mV	
		50 kHz to 100 kHz	0.62 % of reading + 0.8 mV	
		100 kHz to 300 kHz	4.0 % of reading + 5.0 mV	
		3 Hz to 5 Hz	1.0 % of reading + 3.0 mV	
	10 V to 100 V	5 Hz to 10 Hz	0.36 % of reading + 3.0 mV	
		10 Hz to 20 kHz	0.12 % of reading + 3.0 mV	
		20 kHz to 50 kHz	0.16 % of reading + 5.0 mV	
		50 kHz to 100 kHz	0.62 % of reading + 8.0 mV	
		100 kHz to 300 kHz	4.0 % of reading + 50 mV	
		3 Hz to 5 Hz	1.0 % of reading + 30 mV	
	100 V to 750 V	5 Hz to 10 Hz	0.36 % of reading + 30 mV	
		10 Hz to 20 kHz	0.12 % of reading + 30 mV	
		20 kHz to 50 kHz	0.16 % of reading + 50 mV	
		50 kHz to 100 kHz	0.62 % of reading + 80 mV	
		100 kHz to 300 kHz	4.0 % of reading + 0.5 V	
		3 Hz to 5 Hz	1.0 % of reading + 0.225 V	

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) ^{Note 3}	Remarks
Self Generated Noise	1 μ V to 10 V >30 μ V	5 Hz to 10 Hz	0.36 % of reading + 0.225 V	840 RTA HP 8903A
		10 Hz to 20 kHz	0.12 % of reading + 0.225 V	
		20 kHz to 50 kHz	0.16 % of reading + 0.375 V	
		50 kHz to 100 kHz	0.62 % of reading + 0.6 V	
		100 kHz to 300 kHz	4.0 % of reading + 3.75 V	
Signal Distortion Signal Level Range: 100 mV to 10 V 50 mV to 300 V	>0.1 % >0.01 %	0.1 Hz to 20 kHz 20 Hz to 80 kHz	At actual conditions. 0.85 dB 2 dB	840Analyzer HP 8903A
		6 Hz to 20 kHz 20 kHz to 100 kHz	At actual conditions. 4.5 % of reading + 0.03 % distortion 2.3 dB	
Signal to noise ratio <80 dB	50 Hz to 100 kHz	50 mV to 300 V	At actual conditions. 1.5 dB	HP 8903A
TIME AND FREQUENCY				
NVLAP Code: 20/F01 FREQUENCY DISSEMINATION Frequency Dissemination: Frequency and Period	100 mV to 750 V	3 Hz to 5 Hz 5 Hz to 10 Hz 10 Hz to 40 Hz 40 Hz to 300 kHz	At actual conditions. 0.1 % of reading 0.05 % of reading 0.03 % of reading 0.01 % of reading	Agilent 34401A
Time intervals	> 8 s		At actual conditions. 1 s	Chronometer

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) ^{Note 3}	Remarks
PIR Index: Analyzer PIR Intensity Probe	0 dB to 60 dB 0 dB to 60 dB	40 Hz – 10 kHz 40 Hz – 10 kHz	At actual conditions. 1.4 dB 2.5 dB	Broadband Noise Broadband Noise
MECHANICAL				
NVLAP Code: 20/M01 ACOUSTIC			At reference conditions.	
Sensitivity or Open Circuit Sensitivity: Direct and Comparison Methods	-70 dB to <-50 dB re 1 V/Pa	250 Hz	0.12 dB	Comparison and direct 0.3 mV/Pa to 3 mV/Pa
	-50 dB to 0 dB re 1 V/Pa	250 Hz	0.09 dB	3 mV/Pa to 1V/Pa Comparison
	-70 dB to <-50 dB re 1 V/Pa	1 kHz	0.13 dB	0.3 mV/Pa to 3 mV/Pa
	-50 dB to 0 dB re 1 V/Pa	1 kHz	0.11 dB	3 mV/Pa to 1 V/Pa
	At actual conditions.			
	The Free-field and Diffuse Field Responses characteristics are calculated using the measured actuator/pressure response and the correction coefficients provided by the manufacturer of the tested device.			
Frequency Response: Electrostatic Excitation (applicable for condenser microphones with removable grid)	-70 dB to 0 dB re 1 V/Pa	31.5 Hz to 100 Hz >100 Hz to 1.25 kHz >1.25 kHz to 4 kHz >4 kHz to 8 kHz >8 kHz to 10 kHz	Actuator Response / Free-field and Diffuse Field Response 0.20 dB / 0.20 dB 0.14 dB / 0.18 dB 0.14 dB / 0.23 dB 0.17 dB / 0.45 dB 0.38 dB / 0.57 dB	0.3 mV/Pa to 1 V/Pa

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ($k=2$) ^{Note 3}	Remarks	
Frequency Response: Acoustical Method Microphone Sensitivity	-70 dB to 0 dB re 1 V/Pa	>10 kHz to 16 kHz	0.38 dB / 0.77 dB	At actual conditions. The Free-field and Diffuse Field Responses characteristics are calculated using the measured actuator/pressure response and the correction coefficients provided by the manufacturer of the tested device.	
		>16 kHz to 20 kHz	0.59 dB / 0.89 dB		
		>20 kHz to 50 kHz	0.8 dB / 2.1 dB		
		>50 kHz to 100 kHz	1.1 dB / 4.2 dB		
		31.5 Hz	Pressure Response / Free-field and Diffuse Field Response 0.14 dB / 0.17 dB		0.3 mV/Pa to 1 V/Pa; 4226 Calibrator
		63 Hz	0.13 dB / 0.20 dB		1253 Calibrator 4226 Calibrator 1253 Calibrator 4226 Calibrator
		125 Hz	0.13 dB / 0.20 dB		
		250 Hz	0.09 dB / 0.15 dB		
		500 Hz	0.13 dB / 0.16 dB		
		1 kHz	0.11 dB / 0.13 dB		
2 kHz	0.13 dB / 0.22 dB				
Acoustical Calibrators and Pistonphones Sound Pressure Level (SPL)	90 dB to 140 dB re 20 μ Pa	4 kHz	0.13 dB / 0.32 dB	Direct Method At reference conditions. At actual conditions.	
		8 kHz	0.14 dB / 0.44 dB		
		12.5 kHz	0.14 dB / 0.70 dB		
		16 kHz	0.23 dB / 0.75 dB		
		31.5 Hz (± 2 Hz)	0.11 dB		
250 Hz (± 10 Hz)	0.10 dB	0.095 dB			
	0.092 dB				

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty (k=2) ^{Note 3}	Remarks		
Sound Level Stability Sound Pressure Level (SPL)	90 dB to 140 dB re 20 µPa	1 kHz (± 40 Hz)	0.11 dB	At reference conditions. At actual conditions.		
		1 kHz (± 40 Hz)	0.10 dB			
		1250 Hz to 5 kHz	0.11 dB			
				6.3 kHz to 8 kHz	0.14 dB	
				10 kHz to 12.5 kHz	0.16 dB	
				16 kHz	0.21 dB	
Sound Frequency	70 dB to 140 dB re 20 µPa	20 Hz to 20 kHz	0.03 dB	1504A		
		10 Hz to 40 Hz	At actual conditions. 0.03 % of reading	Agilent 34401A		
		40 Hz to 20 kHz	0.01 % of reading			
Frequency Stability	> 0.01 %	10 Hz to 20 kHz	At actual conditions. 5 % of the measured stability value			
Sound Distortion 50 dB to 140 dB re 20 µPa	> 0.1 %	10 Hz to 20 kHz	At actual conditions. 4.5 % of reading + 0.1 % distortion	Analyzer Method		
Sound Level Meters, Dosimeters, Real-time and FFT analyzers, Filter sets	The Free-field and Diffuse Field Responses characteristics are calculated using the measured actuator/pressure response and the correction coefficients provided by the manufacturer of the tested device.					
Acoustical Tests			Pressure Response / Free-field and Diffuse Field Response			

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Sound Pressure Level: Fixed points, Tones	94 dB, 104 dB, 114 dB	31.5 Hz	0.15 dB / 0.20 dB	4226 Calibrator	
		63 Hz	0.14 dB / 0.20 dB		
		125 Hz	0.14 dB / 0.20 dB		
		250 Hz	0.14 dB / 0.15 dB		
		250 Hz	0.09 dB / 0.11 dB		
	124 dB 94 dB, 104 dB, 114 dB	500 Hz	0.14 dB / 0.15 dB	4226 Calibrator	
		1 kHz	0.13 dB / 0.13 dB		
		1 kHz	0.12 dB / 0.13 dB		
		2 kHz	0.14 dB / 0.20 dB		
		4 kHz	0.14 dB / 0.25 dB		
124 dB 94 dB, 104 dB, 114 dB	8 kHz	0.14 dB / 0.45 dB	4226 Calibrator		
	12.5 kHz	0.15 dB / 0.70 dB			
	16 kHz	0.25 dB / 0.75 dB			
	80 dB to 100 dB re 20 μ Pa	2 kHz		0.15 dB	4226 Calibrator
Timed Sounds Measuring Equipment – Generate	94 dB	1 kHz	0.01 % dose		
	104 dB	1 kHz	0.03 % dose		
	114 dB	1 kHz	0.12 % dose		
	124 dB	1 kHz	0.26 % dose		
NVLAP Code: 20/M11 VIBRATION Exciters and Vibration Calibrators Acceleration – Measure	0.1 m/s ² to 200 m/s ²	10 Hz to 40 Hz 40 Hz to 1500 Hz >1.5 kHz to 4 kHz >4 kHz to 10 kHz	At actual conditions. 1.6 % of reading 1.2 % of reading 1.6 % of reading 2.0 % of reading At actual conditions.		

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Measured Parameter or Device Calibrated	Range	Frequency Range	Uncertainty ($k=2$) ^{Note 3}	Remarks
Motion Frequency Acceleration Domain 0.1 m/s ² to 200 m/s ²	3 Hz to 5 Hz >5 Hz to 10 Hz >10 Hz to 40 Hz >40 Hz to 100 Hz >100 Hz to 300 Hz >300 Hz to 10 kHz		0.16 % of reading 0.18 % of reading 0.20 % of reading 0.06 % of reading 0.03 % of reading 0.01 % of reading	Agilent 34401A
Distortion of Motion Vibration Level Domain 0.1 m/s ² to 200 m/s ²	< 0.1 %	10 Hz to 20 kHz	At actual conditions. 4.5 % of reading + 0.1 % distortion	Analyzer Method
Accelerometers			At actual conditions.	Comparison Method
Accelerometer Sensitivity	Charge 0.03 pC/(m/s ²) to 5000 pC/(m/s ²) Voltage 0.03 mV/(m/s ²) to 5 V/(m/s ²)	10 Hz 12.5 Hz to 1000 Hz >1000 Hz to 4 kHz >4 kHz to 10 kHz	1.3 % of reading 1.2 % of reading 1.5 % of reading 2.0 % of reading	
Velocity Sensors	Charge 0.03 pC/(m/s ²) to 5000 pC/(m/s ²) Voltage 0.03 mV/(m/s ²) to 5 V/(m/s ²)	10 Hz to 16 Hz 20 Hz to 80 Hz 100 Hz to 200 Hz 250 Hz to 4 kHz >4 kHz to 10 kHz	At actual conditions. 3 % of reading 2 % of reading 1.3 % of reading 2 % of reading 3 % of reading	Comparison Method

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**National Voluntary
Laboratory Accreditation Program**



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Accelerometer Sensitivity Field calibrations available ^{Note 4}	Charge 0.12 pC/(m/s ²) to 1.2 nC/(m/s ²) Voltage 0.12 mV/(m/s ²) to 1.2 V/(m/s ²)	70 Hz to 400 Hz > 400 Hz to 1 kHz > 1 kHz to 7.5 kHz > 7.5 kHz to 10 kHz	At actual conditions. 2.5 % of reading 2.6 % of reading 6.0 % of reading 6.5 % of reading	Calibrator Method VC-110

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Notes

Note 1: A Calibration and Measurement Capability (CMC) is a description of the best result of a calibration or measurement (result with the smallest uncertainty of measurement) that is available to the laboratory's customers under normal conditions, when performing more or less routine calibrations of nearly ideal measurement standards or instruments. The CMC is described in the laboratory's scope of accreditation by: the measurement parameter/device being calibrated, the measurement range, the uncertainty associated with that range (see note 3), and remarks on additional parameters, if applicable.

Note 2: Calibration and Measurement Capabilities are traceable to the national measurement standards of the U.S. or to the national measurement standards of other countries and are thus traceable to the internationally accepted representation of the appropriate SI (Système International) unit.

Note 3: The uncertainty associated with a measurement in a CMC is an expanded uncertainty using a coverage factor, $k = 2$, with a level of confidence of approximately 95 %. Units for the measurand and its uncertainty are to match. Exceptions to this occur when marketplace practice employs mixed units, such as when the artifact to be measured is labeled in non-SI units and the uncertainty is given in SI units (Example: 5 lb weight with uncertainty given in mg).

Note 3a: The uncertainty of a specific calibration by the laboratory may be greater than the uncertainty in the CMC due to the condition and behavior of the customer's device and specific circumstances of the calibration. The uncertainties quoted do not include possible effects on the calibrated device of transportation, long term stability, or intended use.

Note 3b: As the CMC represents the best measurement results achievable under normal conditions, the accredited calibration laboratory shall not report smaller uncertainty of measurement than that given in a CMC for calibrations or measurements covered by that CMC.

Note 3c: As described in Note 1, CMCs cover calibrations and measurements that are available to the laboratory's customers under *normal conditions*. However, the laboratory may have the capability to offer special tests, employing special conditions, which yield calibration or measurement results with lower uncertainties. Such special tests are not covered by the CMCs and are outside the laboratory's scope of accreditation. In this case, NVLAP requirements for the labeling, on calibration reports, of results outside the laboratory's scope of accreditation apply. These requirements are set out in Annex A.1.h. of NIST Handbook 150, Procedures and General Requirements.

Note 4: Uncertainties associated with field service calibration may be greater as they incorporate on-site environmental contributions, transportation effects, or other factors that affect the measurements. (This note applies only if marked in the body of the scope.)

Note 5: Values listed with percent (%) are percent of reading or generated value unless otherwise noted.

Note 6: NVLAP accreditation is the formal recognition of specific calibration capabilities. Neither NVLAP nor NIST guarantee the accuracy of individual calibrations made by accredited laboratories.

Note 7: See [NIST Handbook 150](#) for further explanation of these notes.

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